FETC SUCCESS

U.S. Department of Energy
Federal Energy Technology Center

CLEAN AFFORDABLE POWER

- [x] fossil energy
- [ ] environmental
- [ ] energy efficiency
- [ ] other

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Premix-Combustion for Reducing Emissions

States Impacted:
California, Ohio, West Virginia, Virginia, Connecticut

Benefit Areas:
Environmental Quality Improved, Lower Cost of Electricity

Participants:
Solar Turbines, Alzeta Corporation, Parker Hannifin, Virginia Polytechnic Institute and State University, United Technologies Research Corporation

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Description

FETC's Advanced Turbine Systems (ATS) Program has made impressive advances in combustor emissions reduction using "premix-combustion." But, the advances are only attainable with very tight control of engine parameters, natural gas fuel properties, and fuel injection. In addition, field difficulties with combustion oscillations and flashback need to be addressed in order to promote ATS.

As a result, FETC's unique combustion test facilities have been the basis of high humidification combustion testing by United Technologies Research Corporation to demonstrate the low emission potential in Humid Air Turbines (HAT). Similarly, FETC's facilities have also been used as part of a Cooperative Research and Development Agreement (CRADA) with Alzeta Corporation, to test a prototype surface-stabilized turbine combustor for low emissions at realistic engine operating conditions. The prototype testing has helped Alzeta, a small-business, to move forward to commercial engine applications.

Under another CRADA, Parker Hannifin and FETC are investigating dual-fuel (liquid-fuel and natural gas) combustion. Testing has identified novel fuel injector to promote stable combustion of either fuel. Various testing is being conducted to understand flame stability and fuel flexibility. Current research with university partner, Virginia Tech, is aimed at developing a useful "reduced-order" model to connect rig-scale test results to full-scale engine performance. And finally, a CRADA with Solar Turbines, has resulted in the development of a novel approach to "active" combustion stabilization in low-emission gas turbine engines.

Goals

In partnership with commercial and university investigators, the goals are to solve the issues associated with wide application of ultra-clean turbine combustion, primarily focusing on increased turbine efficiency and lower emissions.

Tangible Benefits

National: The commercial application of the combustion research will enable electric power producers to meet the stringent emission standards for sulfur dioxide, nitrogen oxides and particulates in the next century. Advanced turbine systems, integral to the Department's Vision 21 concept offer low emissions and ultra-high efficiencies.

Regional: Through the development of dual-fuel (liquid-fuel and natural gas) injectors for the turbines with regional partners, manufacturers will be able to increase the market for ATS engine applications, making the low emission technology available to others.

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